APPENDIX TO "STUDIES ON MESOZOIC AND CAINOZOIC DINOFLAGELLATE CYSTS"

BY

ROGER JACK DAVEY,

CHARLES DOWNIE,
(University of Sheffield)

WILLIAM ANTONY SWITHIN SARJEANT,
(University of Nottingham)

AND GRAHAM LEE WILLIAMS
(Pan-American Petroleum Corp.)

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SYNOPSIS

This Appendix comprises taxonomic revisions necessary to correct inadvertent errors in the Supplement and to take account of subsequent taxonomic studies. The diagnoses of two genera, *Gonyaulacysta* and *Leptodinium*, are emended ; a new genus, *Hystrichogonyaulax*, and two new species, *Perisseiasphaeridium eisenackii* and *Polysphaeridium belgicum*, are proposed ; and revisions in the generic assignation of 114 other species are proposed. Typographical errors are corrected and curatorial amendments are incorporated.

I. INTRODUCTION

In a lengthy review (1967 ; 1030–3), Tappan & Loeblich Jnr. have noted that the new combinations resulting from generic reallocations proposed in our supplement in many instances failed to fulfil the requirements of Article 33, para. 4 of the " International Code of Botanical Nomenclature " (1961 edition, then applicable).

This Appendix attempts to set these matters right. In sections II–V taxonomic reallocations are proposed ; in section VI, taxonomic reallocations by other authors are noted with comments; and in section VII, typographical and phraseological errors in the original work (some of them noted by the reviewers, others noted by the authors) are corrected and certain curatorial amendments to the numbering of specimens are listed. New species and new combinations which were validly published in the original work are not again listed here.

The authors gratefully acknowledge helpful comments received from Dr. William R. Evitt (Stanford University, California) and Dr. Alfred R. Loeblich Jnr. (Chevron Research Company, La Habra, California). The work by W. A. S. Sarjeant was done whilst Visiting Professor at the University of Oklahoma, Norman, Oklahoma, U.S.A.: he would like to express personal thanks to Dr. Charles J. Mankin for his support and encouragement.

II. GENERIC REALLOCATIONS (R.J.D. & G.L.W.)

Achomosphaera alcicornu (Eisenack) Davey & Williams, comb. nov., =*Hystrichosphaeridium alcicornu* Eisenack, 1954 ; 65–6, pl. 10 figs 1–2, text-fig. 5. Oligocene, East Prussia, U.S.S.R.

Achomosphaera grallaeforme (Brosius) Davey & Williams, comb. nov., =*Hystrichosphaeridium grallaeforme* Brosius, 1963 ; 42 pl. 5 fig. 3, text-fig. 2 nos. 3 a–b. Oligocene, Germany.

Achomosphaera hyperacantha (Deflandre & Cookson) Davey & Williams, comb. nov., =*Hystrichosphaera hyperacantha* Deflandre & Cookson, 1955 ; 264–5, pl. 6 fig. 7. Miocene, Australia.

Achomosphaera hirundo (Eisenack) Davey & Williams, comb. nov., =*Hystrichosphaeridium hirundo* Eisenack, 1958 ; 404–5, pl. 24 fig. 12. Lower Cretaceous, Germany.

Achomosphaera triangulata (Gerlach) Davey & Williams, comb. nov., =*Baltisphaeridium triangulatum* Gerlach, 1961 ; 194–5, pl. 29 fig. 1. Miocene, Germany.

Cymatiosphaera membranacea (Philippot) Davey & Williams, comb. nov., =*Hystrichosphaeridium membranaceum* Philippot, 1949 ; 57–8, text-fig. 3. Upper Cretaceous, France. (Acritarch).

?Hystrichokolpoma xiphea (Maier) Davey & Williams, comb. nov., =*Galea xiphea* Maier 1959 ; 309, pl. 30 fig. 5 (transferred to *Hystrichosphaeridium* by Sarjeant, 1964 ; 176). Oligocene, Germany.

Hystrichosphaera leptoderma (Maier) Davey & Williams, comb. nov., =*Hystrichosphaeridium leptodermum* Maier, 1959 ; 321–2, pl. 33 figs. 5–6. Oligocene, Germany.

Oligosphaeridium albertense (Pocock) Davey & Williams, comb. nov., =*Hystrichosphaeridium albertense* Pocock, 1962 ; 82, pl. 15 figs. 226–7. Lower Cretaceous, Alberta, Canada.

?Oligosphaeridium asterigerum (Gocht) Davey & Williams, comb. nov., =*Hystrichosphaeridium asterigerum* Gocht, 1959 ; 67–8, pls. 3 fig. 1, 7 figs. 1–3. Lower Cretaceous, Germany.

?Oligosphaeridium coelenteratum (Tasch) Davey & Williams, comb. nov., =*Hystrichosphaeridium coelenteratum* Tasch *in* Tasch, McClure & Oftedahl, 1964 ; 195, pl. 2 fig. 11. Lower Cretaceous, Kansas, U.S.A.

Oligosphaeridium dictyophorum (Cookson and Eisenack) Davey & Williams, comb. nov., =*Hystrichosphaeridium dictyophorum* Cookson & Eisenack, 1958 ; 44, pl. 11 fig. 14. Upper Jurassic, Papua.

?Oligosphaeridium dispare (Tasch) Davey & Williams, comb. nov., =*Hystrichosphaeridium dispare* Tasch *in* Tasch, McClure & Oftedahl, 1964 ; 195, pl. 2 fig. 8. Lower Cretaceous, Kansas, U.S.A.

?Oligosphaeridium irregulare (Pocock) Davey & Williams, comb. nov., =*Hystrichosphaeridium irregulare* Pocock, 1962 ; 82–3, pl. 15 figs. 228–9, *non Hystrichosphaeridium irregulare* (Merrill) Sarjeant, 1964. [The holotype of this latter species, originally described (as *?Geodia irregularis*) from the Middle Cretaceous of Texas, U.S.A., is lost ; it is considered to be a junior synonym of *Hystrichosphaeridium complex* (White, 1842) Deflandre, 1946b, by Sarjeant, 1966a ; 8]. Lower Cretaceous, Alberta, Canada.

?Oligosphaeridium paradoxum (Brosius) Davey & Williams, comb. nov., =*Hystrichosphaeridium paradoxum* Brosius, 1963 ; 41–2, pl. 4 fig. 6, text-fig. 2, nos. 1a–c. Oligocene, Germany.

Oligosphaeridium perforatum (Gocht) Davey & Williams, comb. nov., =*Hystrichosphaeridium perforatum* Gocht, 1959 ; 68–9, pls. 3 fig. 7 ; 7 figs. 13–16. Lower Cretaceous, Germany.

?Litosphaeridium crassipes (Reade) Davey & Williams, comb. nov., =*Xanthidium crassipes* Reade, 1839 ; pl. 9 figs. 2–5. (Transferred to *Hystrichosphaeridium* by Lejeune-Carpentier, 1941 ; 79–80). Upper Cretaceous, England.

?Litosphaeridium flosculus (Deflandre) Davey & Williams, comb. nov., =*Hystrichosphaeridium flosculus* Deflandre, 1937 ; 75–6, pl. 15 figs. 5–6. Upper Cretaceous, France.

?Litosphaeridium truncigerum (Deflandre) Davey & Williams, comb. nov., =*Hystrichosphaeridium truncigerum* Deflandre, 1937 ; 71–2, pl. 13 figs. 6–7. Upper Cretaceous, France.

?Cordosphaeridium cantharellum (Brosius) Davey & Williams, comb. nov., =*Hystrichosphaeridium cantharellum* Brosius, 1963 ; 40–1, pl. 6 fig. 1, text-fig. 2 nos. 11a–c. Oligocene, Germany.

?Cordosphaeridium erectum (Manum & Cookson) Davey & Williams, comb. nov., =*Hystrichosphaeridium erectum* Manum & Cookson, 1964 ; 14, pl. 3 figs. 5–6. Cretaceous, Arctic Canada.

Perisseiasphaeridium eisenackii Davey & Williams, sp. nov., =*Hystrichosphaeridium anthophorum* sensu Eisenack, 1958 ; 402, pl. 26 figs. 1–2 *non* Cookson & Eisenack, 1958. Holotype : the specimen figured by Eisenack, 1958 ; pl. 26 fig. 1, and contained in his Slide Ob. Apt. no. 31. Dimensions of holotype : diameter of central body 55μ, overall diameter 110μ. Lower Cretaceous (Upper Aptian), Germany. (Name originally proposed by Davey & Williams, 1966b ; 79 : invalid under Art. 37, since the holotype was not designated).

?Polysphaeridium asperum (Maier) Davey & Williams, comb. nov., =*Hystrichosphaeridium asperum* Maier, 1959 ; 319: pl. 33 fig. 2. Miocene, Germany.

?Polysphaeridium deflandrei (Valensi) Davey & Williams, comb. nov., =*Hystrichosphaeridium deflandrei* Valensi, 1947 ; 817–8, text-fig. 3. Middle Jurassic France.

?Polysphaeridium fabium (Tasch) Davey & Williams, comb. nov., =*Hystrichosphaeridium fabium* Tasch, *in* Tasch, McClure & Oftedahl, 1964 ; 195, pl. 2 fig. 5. Lower Cretaceous, Kansas, U.S.A.

?Polysphaeridium follium (Tasch) Davey & Williams, comb. nov., =*Hystrichosphaeridium follium* Tasch, *in* Tasch, McClure & Oftedahl, 1964 ; 195, pl. 1 fig. 8. Lower Cretaceous, Kansas, U.S.A.

?Polysphaeridium fucosum (Valensi) Davey & Williams, comb. nov., =*Micrhystridium fucosum* Valensi, 1955a ; 40, text-fig. 2b (Transferred to *Hystrichosphaeridium* by Downie and Sarjeant, 1963 ; 93). Cretaceous, France.

?Polysphaeridium major (Lejeune-Carpentier) Davey & Williams, comb. nov., =*Hystrichosphaeridium major* Lejeune-Carpentier, 1940 ; 220–1, text-fig. 13. Upper Cretaceous, Belgium.

?Polysphaeridium marsupium (Tasch) Davey & Williams, comb. nov., =*Hystrichosphaeridium marsupium* Tasch, *in* Tasch, McClure & Oftedahl, 1964 ; 193, pl. 3 fig. 16. Lower Cretaceous, Kansas, U.S.A.

?Polysphaeridium paulinae (Valensi) Davey & Williams, comb. nov., =*Micrhystridium paulinae* Valensi, 1953 ; 48, pl. 12 fig. 6 (Transferred to *Hystrichosphaeridium* by Downie and Sarjeant, 1963 ; 93). Middle Jurassic, France.

?Polysphaeridium perovatum (Tasch) Davey & Williams, comb. nov., =*Hystrichosphaeridium perovatum* Tasch, *in* Tasch, McClure & Oftedahl, 1964 ; 194, pl. 3 fig. 13. Lower Cretaceous, Kansas, U.S.A.

?Polysphaeridium rhabdophorum (Valensi) Davey & Williams, comb. nov., =*Hystrichosphaeridium rhabdophorum* Valensi, 1955b ; 593–4, pl. 3 fig. 7. Cretaceous, France.

?Polysphaeridium simplex (White) Davey & Williams, comb. nov., =*Xanthidium tubiferum* subsp. *simplex* White, 1842 ; 38–9, pl. 4 div. 3 fig. 10 (elevated to specific status, as *Hystrichosphaeridium simplex*, by Deflandre, 1946a ; card 934). Upper Cretaceous, England.

?Polysphaeridium tribrachiosum (Tasch) Davey & Williams, comb. nov., =*Hystrichosphaeridium tribrachiosum* Tasch *in* Tasch, McClure & Oftedahl, 1964 ; 195, pl. 1 fig. 3. Lower Cretaceous, Kansas, U.S.A.

?Diphyes monstruosum (Tasch) Davey & Williams, comb. nov., =*Hystrichosphaeridium monstruosum* Tasch *in* Tasch, McClure & Oftedahl, 1964 ; 195, pl. 1 fig. 12. Lower Cretaceous, Kansas, U.S.A.

Tanyosphaeridium ellipticum (Cookson) Davey & Williams, comb. nov., =*Hystrichosphaeridium ellipticum* Cookson, 1965 ; 87–8, pl. 11 figs. 1–3a. Upper Eocene, Australia.

Tanyosphaeridium isocalamus (Deflandre & Cookson) Davey & Williams, comb. nov., =*Hystrichosphaeridium isocalamus* Deflandre & Cookson, 1955 ; 272, pl. 2 figs 7–8, text-figs 30–35. Lower Cretaceous, Australia.

III. TAXONOMIC CHANGES PROPOSED BY W. A. S. SARJEANT

In a recent publication, Wall (1967 ; 98) has discussed the difficulties encountered in distinguishing between the genera *Gonyaulacysta* and *Leptodinium*. Hitherto this had been done on the presence of a sixth precingular plate (numbered as plate 1''') in the former genus—a feature frequently difficult to discern, even in the type species, *G. jurassica*. Wall proceeded to formulate a revised diagnosis for the genus *Leptodinium*, emphasizing the absence of apical or antapical structures and the simplicity of the crests, which are typically low and lack spines or other outgrowths (1967 ; 104). This diagnosis did not take account of the revisions in these two genera proposed by Sarjeant (1966b ; 111, 113) ; and so revised diagnoses for the genera *Gonyaulacysta* and *Leptodinium*, embodying ideas drawn from both sources, are now given. Two species which fall outside the revised diagnoses of both genera are placed into a new genus, here proposed.

Genus ***GONYAULACYSTA*** Deflandre ex Norris & Sarjeant 1965 emend, Sarjeant, herein

1964 *Gonyaulacysta* gen. nov. Deflandre : 5. [Type species not validly proposed : see I.C.B.N. Art. 33 para. 4].
1965 *Gonyaulacysta* Deflandre ; Norris and Sarjeant : 65. [Type species validly proposed].
1966 *Gonyaulacysta* Deflandre ; Loeblich & Loeblich : 33.
1966b *Gonyaulacysta* Deflandre ; emend. Sarjeant : 111.
1967 *Gonyaulacysta* Deflandre ; Wall : 98 (discussion only : no diagnosis given).

Emended diagnosis. Proximate dinoflagellate cysts, spherical, ovoidal, ellipsoidal or polyhedral, with an apical horn and the reflected tabulation 3–4′, 0–1a, 6″, 6c, 5–6‴, 1 p, 0–1 p.v., 1⁗, 0–x s. Cingulum strongly or weakly helicoid ; cingular plates well or poorly marked. Sulcus generally but not constantly extending on to the epitract ; undivided or subdivided into a variable number of small plates. Apical horn typically formed from the periphragm only, less frequently from both shell layers ; rarely, an apical or antapical pericoel is present (but not both), but the two layers are most often otherwise in continuous contact. Median and antapical horns lacking. Sutures marked by low ridges ; bearing crests of varied form (smooth, denticulate or spinous, perforate or imperforate) ; or marked by lines of spines of varied form. Height of spines or crests always less than $\frac{1}{4}$ of shell width. A precingular single-plate archaeopyle, formed by loss of plate 3″, is developed, the operculum typically becoming wholly detached : in some individual specimens, the archaeopyle may not be developed. Surface of periphragm smooth, granular, nodose, punctate or reticulate ; forms with a general spine cover are excluded.

Type species. *Gonyaulacysta jurassica* (Deflandre) Norris & Sarjeant, 1965 =*Gonyaulax jurassica* Deflandre, 1938 ; 168–70, pl. 6 figs. 2–5, text-figs. 1–2. Upper Jurassic (Oxfordian), France.

Remarks. The diagnosis is emended to include the presence of an apical horn, formed by an outbulge of the periphragm or of both shell layers, as an essential characteristic. Species in which an apical prominence is developed merely from the junction of crests, such as *Leptodinium freakei* (Sarjeant) Sarjeant and *Leptodinium millioudi* (Sarjeant) Sarjeant, are excluded, as are species with a general spine cover or with especially long sutural spines (see discussion in Sarjeant, 1966b ; 111). Species having an apical or epitractal archaeopyle, species having a precingular archaeopyle formed by the loss of the equivalent of more than one plate, and species having a combination archaeopyle are excluded. The currently known range of the genus is Middle Jurassic—Miocene.

Other species.

Gonyaulacysta aculeata (Klement) Sarjeant, comb. nov., =*Gonyaulax aculeata* Klement, 1960 ; 42–4, pl. 5 figs. 6–9, text-fig. 21. Upper Jurassic, Germany.

Gonyaulacysta aichmetes Sarjeant, 1966b ; 123–4, pl. 13 figs. 5–6, text-fig. 30. Lower Cretaceous, England.

Gonyaulacysta ambigua (Deflandre) Sarjeant, comb. nov. =*Gonyaulax ambigua* Deflandre, 1939 ; 144, pl. 6 fig. 2. Upper Jurassic, France.

(Note : The indirect citation of Deflandre's paper in Sarjeant 1968, does not conform to Art. 33 para. 3 and note 1 of the ' I.C.B.N.'. The new combination is, therefore, here reproposed.)

Gonyaulacysta apionis (Cookson & Eisenack) Sarjeant, comb. nov., =*Gonyaulax apionis* Cookson & Eisenack, 1958 ; 36, pl. 3 fig. 7, text-figs. 3–4. Lower Cretaceous, Australia.

Gonyaulacysta axicerastes Sarjeant, 1966b ; 114–6, pl. 13 figs. 11–12, text-fig. 25. Lower Cretaceous, England.

Gonyaulacysta cassidata (Eisenack & Cookson) Sarjeant, 1966b ; 125–6, pl. 14 figs. 3–4, text-fig. 31 =*Gonyaulax helicoidea* subsp. *cassidata* Eisenack & Cookson, 1960 ; 3, pl. 1, figs. 5–6. Lower Cretaceous, Australia.

Gonyaulacysta cladophora (Deflandre) Sarjeant, comb. nov., =*Gonyaulax cladophora* Deflandre, 1938 ; 173–6, pl. 7 figs. 1–5, text-figs. 5–6. Upper Jurassic, France.*

Gonyaulacysta confusa (Vozzhennikova) Sarjeant, comb. nov., =*Gonyaulax confusus* (sic) Vozzhennikova, 1967 : 80, pl. 17, figs. 1a,b ; pl. 25, figs. 4–5, pl. 27, figs. 3–4. Upper Jurassic, U.S.S.R.

Gonyaulacysta crassicornuta (Klement) Sarjeant, comb. nov., =*Gonyaulax crassicornuta* Klement, 1960 ; 38–9, pl. 5 figs. 1–3. Upper Jurassic, Germany.

Gonyaulacysta cretacea (Neale & Sarjeant) Sarjeant, comb. nov., =*Gonyaulax cretacea* Neale & Sarjeant, 1962 ; 441–3, pl. 19 figs. 1–2, text-fig. 2. Lower Cretaceous, England.

Gonyaulacysta crispa (W. Wetzel) Sarjeant, comb. nov., =*Conyaulax crispa* W. Wetzel 1966 ; 870, pl. 15, figs 4a–b. Middle Jurassic, Germany.

Gonyaulacysta dangeardi Sarjeant, 1968 ; 226–7, pl. 1 fig. 21, pl. 3 figs. 8, 15, text-fig. 3. Upper Jurassic, France.

Gonyaulacysta diaphanis (Cookson & Eisenack) Sarjeant, comb. nov., =*Gonyaulax diaphanis* Cookson & Eisenack, 1958 ; 36–7, pl. 3 figs. 13–14, text-figs. 10–11. Lower Cretaceous, Australia.

Gonyaulacysta dictyophora (Deflandre) Sarjeant, comb. nov., =*Palaeoperidinium dictyophorum* Deflandre, 1938 ; 178–9, pl. 8 figs. 1–3. [NOTE : Sarjeant, 1967 ; 249, formulated an emended diagnosis for this species and proposed its transfer to *Gonyaulacysta*. The generic transfer is, however, invalid in that the original place of publication cited was indirect (via the Downie & Sarjeant " Bibliography ") and not direct (I.C.B.N. Art 33 para. 1 and note 1). The emended diagnosis is considered applicable to this new combination.] Upper Jurassic, France.

Gonyaulacysta eisenacki (Deflandre 1938 ; 171–3, pl. 6 figs. 7–10, text-figs. 3–4) Sarjeant, 1968 ; 227, pl. 3 fig. 14. Upper Jurassic, France.

Gonyaulacysta episoma Sarjeant, 1966b ; 118–19, pl. 13 figs. 9–10, text-fig. 27. Lower Cretaceous, England.

Gonyaulacysta exilicristata Davey, 1968a ; 121, pl. 1, figs. 1–2, text-figs. 9A–B. Upper Cretaceous, England.

Gonyaulacysta fetchamensis Sarjeant 1966b ; 128–30, pl. 15 figs. 1–2, text-fig. 33. Upper Cretaceous, England.

Gonyaulacysta giuseppei (Morgenroth) Sarjeant, comb. nov., =*Gonyaulax giuseppei* Morgenroth, 1966 ; 5–6, pl. 2 figs. 3–6. Eocene, Germany.

Gonyaulacysta gongylos Sarjeant, 1966b ; 111–13, pl. 13 figs. 1–2, text-fig. 23. Upper Jurassic, England.

Gonyaulacysta gottisi Dupin 1968 ; 4, pl. 1 figs 7–12. Upper Jurassic, France.

Gonyaulacysta granulata (Klement) Sarjeant, comb. nov., =*Gonyaulax granulata* Klement, 1960; 39–41, pl. 4 figs. 10–13, text-figs. 18–20. Upper Jurassic, Germany.

Gonyaulacysta granuligera (Klement) Sarjeant, comb. nov., =*Gonyaulax granuligera* Klement, 1960 ; 41–2, pl. 5 figs. 4–5. Upper Jurassic, Germany.

Gonyaulacysta hadra Sarjeant, 1966b ; 119–21, pl. 14 fig. 1, text-fig. 28. Lower Cretaceous, England.

Gonyaulacysta helicoidea (Eisenack & Cookson) Sarjeant, 1966b ; 116–17, pl. 13 figs. 7–8, pl. 15 figs. 8–9, text-fig. 26, =*Gonyaulax helicoidea* Eisenack & Cookson, 1960 ; 2–3, pl. 2, figs. 4–9. Lower Cretaceous, Australia.

Gonyaulacysta hyaloderma (Deflandre, 1939 ; 144, pl. 6 figs 3–4) Sarjeant, 1967 ; 252. Upper Jurassic, France.

Gonyaulacysta hyalodermopsis (Cookson & Eisenack) Sarjeant, comb. nov., =*Gonyaulax hyalodermopsis* Cookson & Eisenack, 1958 ; 34, pl. 3 figs. 11–12, text-figs. 5–6. Lower Cretaceous, Australia.

Gonyaulacysta longicornis (Downie) Sarjeant, comb. nov., =*Gonyaulax longicornis* Downie, 1957 ; 420, pl. 20 fig. 8, text-figs. 2a–b. Upper Jurassic, England.

Gonyaulacysta kostromiensis (Vozzhennikova) Sarjeant, comb. nov., =*Gonyaulax kostromiensis* Vozzhennikova, 1967, 85–6, pl. 26, figs. 1–6, pl. 27, figs. 1–2. Lower Cretaceous, U.S.S.R.

?***Gonyaulacysta mamillifera*** (Deflandre) Sarjeant, comb. nov., =*Gonyaulax mamillifera* Deflandre, 1939 ; 143, pl. 6 fig. 1. Upper Jurassic, France.

Gonyaulacysta microceras (Eisenack) Clarke & Verdier, 1967 ; 31, =*Gonyaulax microceras* Eisenack, 1958 ; 391, pl. 21 figs. 12–13. Lower Cretaceous, Germany.

Gonyaulacysta monacantha (Deflandre, 1935 ; 228, pl. 6 fig. 1) Sarjeant, 1967 ; 252. Upper Cretaceous, France.

?***Gonyaulacysta nannotrix*** (Deflandre) Sarjeant, comb. nov., =*Gonyaulax nannotrix* Deflandre, 1939 ; 143, pl. 6 fig. 7. Upper Jurassic, France.

Gonyaulacysta nuciformis (Deflandre, 1938 ; 180, pl. 8 figs. 4–6, emend. Sarjeant, 1962b ; 482, pl. 6 fig. 6, text-fig. 4) Sarjeant, 1968 ; 227, pl. 3 fig. 4. Upper Jurassic, France. (Originally placed by Deflandre in the genus *Palaeoperidinium* : later transferred to *Gonyaulax* by Sarjeant, 1962b).

Gonyaulacysta obscura (Lejeune-Carpentier) Sarjeant, comb. nov., =*Gonyaulax obscura* Lejeune-Carpentier, 1946 ; 191–3, text-figs. 3–5. Upper Cretaceous, Belgium.

Gonyaulacysta pachyderma (Deflandre) Sarjeant, comb. nov., =*Gonyaulax pachyderma* Deflandre, 1938 ; 176–8, pl. 7 figs. 6–10, text-figs. 7–10. Upper Jurassic, France.

Gonyaulacysta palla Sarjeant, 1966b ; 113–4, pl. 13 figs. 3–4, text-fig. 24. Lower Cretaceous, England.

Gonyaulacysta parorthoceras Davey, 1968b ; 1 (=*G. orthoceras* Sarjeant, 1966b ; 121–3, pl. 14 figs. 5–6, text-fig. 29, =*Gonyaulax orthoceras* Eisenack, 1958, pl. 21 figs. 3–11, pl. 24 fig. 1, text-figs. 2–3, pars). Lower Cretaceous, England.

Gonyaulacysta perforans (Cookson and Eisenack) Sarjeant, comb. nov., =*Gonyaulax perforans* Cookson & Eisenack, 1958 ; 30–32, pl. 2 figs. 1–4, 7, 8, text-figs. 8–9. Upper Jurassic, Papua.

Gonyaulacysta pyra (Drugg) Sarjeant, comb. nov., =*Gonyaulax pyra* Drugg, 1967 ; 14, pl. 1 fig. 17, pl. 9 figs. 6a–b. Upper Cretaceous-Paleocene, California, U.S.A.

Gonyaulacysta sarjeanti (Vozzhennikova) Sarjeant, comb. nov., =*Gonyaulax sarjeanti* Vozzhennikova, 1967 ; 87–8, pl. 31, figs. 1–3. Upper Jurassic, U.S.S.R.

Gonyaulacysta scarburghensis Sarjeant, 1964 ; 472–3 (=*Gonyaulax areolata* Sarjeant, 1961a ; 95–7, pl. 13 fig. 13, text-fig. 5, nom. nud.). Upper Jurassic, England.

Gonyaulacysta scotti (Cookson & Eisenack) Sarjeant, comb. nov., =*Gonyaulax scotti* Cookson & Eisenack, 1958 ; 30, pl. 2 figs. 5–6. Upper Jurassic, Australia.

Gonyaulacysta serrata (Cookson & Eisenack) Sarjeant, comb. nov., =*Gonyaulax serrata* Cookson & Eisenack, 1958 ; 34, pl. 3 fig. 2, text-figs. 12–14. Upper Jurassic–Lower Cretaceous, Papua.

?***Gonyaulacysta tenuiceras*** (Eisenack) Sarjeant, comb. nov., =*Gonyaulax tenuiceras* Eisenack, 1958 ; 389–91, pl. 21 figs. 14–15, pl. 22 figs. 1–3, pl. 24 fig. 2, text-figs. 4–5. Lower Cretaceous, Germany.

Gonyaulacysta tenuicornuta (Cookson & Eisenack) Sarjeant, comb. nov., =?*Leptodinium tenuicornutum* Cookson & Eisenack, 1962 ; 478, pl. 3 figs. 12–13, text-fig. 1a, b. ?Lower Cretaceous, Australia.

Gonyaulacysta tenuitabulata (Gerlach) Sarjeant, comb. nov., =*Gonyaulax tenuitabulata* Gerlach, 1961 ; 159–61, pl. 25 figs. 10–11, text-figs. 1–3. Oligocene-Miocene, Germany.

?***Gonyaulacysta transparens*** (Sarjeant) Sarjeant, comb. nov., =*Gonyaulax transparens* Sarjeant, 1959 ; 334–5, pl. 13 fig. 3, text-fig. 3. Middle Jurassic England.

Gonyaulacysta wetzeli (Lejeune-Carpentier) Sarjeant, comb. nov., =*Gonyaulax wetzeli* Lejeune-Carpentier, 1939 ; 525–9, text-figs. 1–2. Upper Cretaceous, Germany.

Gonyaulacysta whitei Sarjeant, 1966b ; 126–8, pl. 14 fig. 2, text-fig. 32. Upper Cretaceous, England.

Genus ***LEPTODINIUM*** Klement 1960
emend. Wall 1967, emend.

1960 *Leptodinium* gen. nov. Klement : 45.
1965 *Leptodinium* Klement ; Norris & Sarjeant : 37.
1966 *Leptodinium* Klement ; Loeblich & Loeblich : 38.
1966b *Leptodinium* Klement ; emend. Sarjeant : 133–4.
1967 *Leptodinium* Klement ; emend. Wall : 104.

EMENDED DIAGNOSIS. Proximate dinoflagellate cysts, spheroidal, ovoidal, ellipsoidal or polyhedral, with reflected tabulation 3–4′, 0–1a, 6″, 6c, 5–6‴, 1p, 0–1 p.v., 1⁗, 0–x s. Apical, median and antapical horns lacking. Cingulum strongly or weakly helicoid, laevorotatory ; cingular plates well or poorly marked. Sulcus generally but not constantly extending onto epitract, undivided or subdivided into

a variable number of small plates. Rarely, an apical or an antapical pericoel may be present (but not both) ; the two shell layers are otherwise in continuous contact. Sutures typically marked by ridges or low crests (perforate or imperforate), without spines or denticles. Height of crests always less (and typically markedly less) than $\frac{1}{4}$ of shell width. A precingular single-plate archaeopyle, formed by loss of plate 3", is developed, the operculum typically becoming wholly detached ; in some specimens, the archaeopyle may not be developed. Surface of periphragm smooth, granular, or punctate. Forms with nodose or reticulate surface have not been encountered and forms with crest spines or with general spine cover are excluded.

Type species. ***Leptodinium subtile*** Klement, 1960 ; 46–47, pl. 6 figs. 1–4, text-figs. 23–24. Upper Jurassic (Kimmeridgian), Germany.

Remarks. The diagnosis here formulated is an expansion of that given by Wall (1967) : it differs in being more detailed and in permitting the inclusion of forms showing differentiation of the ventral surface into plates. Species with an apical horn are allocated to *Gonyaulacysta* ; species with sutures marked by lines of high spines are placed in *Hystrichogonyaulax* gen. nov.; species with a general spine cover are placed in the genus *Acanthaulax*. The currently known range of the genus *Leptodinium*, as here defined, is Upper Jurassic to Recent.

Other species.

Leptodinium aceras (Eisenack) Sarjeant, comb. nov., =*Gonyaulax aceras* Eisenack, 1958 ; 391–2, pl. 21 figs. 1–2. Lower Cretaceous, Germany.

Leptodinium aculeatum Wall, 1967 ; 104–5, pl. 14 figs. 18–19, text-figs. 3C, 3D. Pleistocene—Recent, Yucatan Basin, Caribbean Sea.

Leptodinium alectrolophum Sarjeant, 1966b ; 134–5, pl. 15 figs. 3–6, text-fig. 34. Lower Cretaceous, England.

Leptodinium amabilis (Deflandre) Sarjeant, comb. nov., =*Gonyaulax amabilis* Deflandre, 1939 ; 143, pl. 6 fig. 8. Upper Jurassic, France.

Leptodinium arcuatum Klement, 1960 ; 48, pl. 6 figs 5–6. Upper Jurassic, Germany.

Leptodinium clathratum (Cookson & Eisenack) Sarjeant, comb. nov., =*Gonyaulax clathrata* Cookson & Eisenack, 1960b ; 246–7, pl. 37 fig. 5, text-fig. 2. Upper Jurassic, Australia.

?Leptodinium crassinervum (Deflandre) Sarjeant, comb. nov., =*Palaeoperidinium crassinervum* Deflandre, 1939 ; 144, pl. 6 fig. 5. (Transfer of this species to *Gonyaulacysta* was proposed by Sarjeant, 1967 ; 248–9). Upper Jurassic, France.

Leptodinium delicatum (Davey) Sarjeant, comb. nov., =*Gonyaulacysta delicata* Davey, 1968a ; 123–4, pl. 1, figs. 7, 8, text-figs. 10A,B. Upper Cretaceous, Saskatchewan, Canada.

Leptodinium eumorphum (Cookson & Eisenack, 1960b ; 246, pl. 37 figs. 1–3, text-fig. 3) Eisenack, 1961 ; 324. Upper Jurassic, Australia.

Leptodinium freakei (Sarjeant) Sarjeant, comb. nov., =*Gonyaulax freakei* Sarjeant, 1963b ; 85–6, pl. 1 figs. 1–3. Upper Jurassic, England.

Leptodinium maculatum Cookson & Eisenack, 1961 ; 40, pl. 2 figs. 5–6. ?Upper Eocene, Rottnest Island, Australia.

Leptodinium margaritiferum (Cookson & Eisenack) Sarjeant, comb. nov., =*Gonyaulax margaritifera* Cookson & Eisenack, 1960a ; 5–6, pl. 2 figs. 1–2, text-fig. 1. Upper Cretaceous, Western Australia.

Leptodinium membranigerum Gerlach, 1961 ; 162–165, pl. 26 figs. 1–4, 7, text-figs 4,5. Oligocene-Miocene, Germany.

Leptodinium millioudi (Sarjeant) Sarjeant, comb. nov., =*Gonyaulax millioudi* Sarjeant, 1963b ; 86–88, pl. 1 figs. 4–7. Upper Jurassic, Switzerland.

Leptodinium mirabile Klement, 1960 ; 48–50, pl. 6 figs. 7–10, text-fig. 25–7. Upper Jurassic, Germany.

?Leptodinium mosaicum (Downie) Sarjeant, comb. nov., =*Palaeoperidinium mosaicum* Downie, 1957 ; 424, pl. 20 fig. 7, text-fig. 2f. (Transfer of this species to *Gonyaulacysta* was proposed, as a provisional measure, by Sarjeant 1967 ; 253). Upper Jurassic, England.

Leptodinium paradoxum Wall, 1967 ; 106–7, pl. 15 figs. 5–8, text-figs. 2, 3A, 3B. Miocene—Recent, Yucatan Basin, Caribbean Sea.

?Leptodinium pilum (Gocht) Sarjeant, comb. nov., =*Palaeoperidinium pilum* Gocht, 1959 ; 56–7, pl. 6 fig. 14, pl. 8 fig. 8. (Transfer of this species to *Gonyaulacysta* was proposed, as a provisional measure, by Sarjeant, 1967 ; 255). Lower Cretaceous, Germany.

Leptodinium porosum (Lejeune-Carpentier) Sarjeant, comb. nov., =*Gonyaulax porosa* Lejeune-Carpentier, 1946 ; 193 196, text-fig. 6. Upper Cretaceous, Belgium.

Leptodinium sphaericum Wall, 1967 ; 108, pl. 15 figs. 11–15, text-fig. 2a–c. Pleistocene—Recent, Yucatan Basin, Caribbean Sea.

Leptodinium strialatum Wall, 1967 ; 107–8, pl. 15 figs. 9–10, text-fig. 5. Miocene—Recent, Yucatan Basin, Caribbean Sea.

Leptodinium striatum (Clarke & Verdier) Sarjeant, comb. nov., =*Gonyaulacysta striata* Clarke and Verdier, 1967 ; 31–32, pl. 4 figs. 11–13, pl. 5 fig. 15, text-fig. 12. Upper Cretaceous, England.

Genus ***HYSTRICHOGONYAULAX*** gen. nov.

Derivation of name. In reference to the *Gonyaulax*-type tabulation exhibited. and to the presence of spines on the sutures.

Diagnosis. Proximate dinoflagellate cysts, spheroidal, ovoidal, ellipsoidal or polyhedral, with the reflected tabulation 3–4′, 0–1a, 6″, 6c, 5–6‴, 1p, 0–1 p.v., 1⁗, 0–x s. Apical, median and antapical horns lacking. Cingulum strongly or weakly helicoid, laevorotatory ; cingular plates well or poorly marked. Sulcus generally but not constantly extending onto the epitract, undivided or subdivided into a variable number of small plates. Rarely, an apical or an antapical pericoel may be present (but not both) ; the two shell layers are otherwise in continuous contact. Sutures marked by lines or low ridges from which arise isolated spines ; the length of spines may vary according to position on the test (e.g. the spines

ringing the antapex may be longer than the others), or may be relatively constant. The spines may be simple or may bifurcate or ramify near the tips : their length is constantly less than $\frac{1}{4}$ of the longest shell cross-measurement. A precingular single-plate archaeopyle, formed by loss of plate 3'', is developed. Surface of periphragm smooth, granular or punctate. Forms with a nodose or reticulate surface have not, to date, been encountered : those with a general spine cover are excluded.

TYPE SPECIES. ***Hystrichogonyaulax cornigera*** (Valensi) Sarjeant, comb. nov., =*Gonyaulax cornigerum* (sic) Valensi, 1953 ; 27, pl. 1 figs. 4, 8, 10, pl. 2 figs. 1–2, pl. 13 fig. 5, text-fig. 2a. Middle Jurassic (Upper Bathonian), France.

OTHER SPECIES. ***Hystrichogonyaulax nealei*** (Sarjeant) Sarjeant, comb. nov., =*Gonyaulax nealei* Sarjeant, 1962 ; 480–1, pl. 69 fig. 1, text-fig. 2. Upper Jurassic, England.

REMARKS. This new genus corresponds to *Leptodinium* in its general morphology, differing in the possession of long sutural spines instead of low crests. It is most abundant in the Middle Jurassic and is characteristically numerous in Northwest European Bathonian sediments : the total known range is Middle to lower Upper Jurassic. On morphological grounds, it might be visualized as possibly ancestral to the genus *Gonyaulacysta* (which includes the species *G. cladophora*, with similar sutural spines but with an apical horn) and to the genus *Leptodinium*, by loss of the sutural spines ; at present, however, this must be regarded as a speculation only.

Other generic reallocations

Dichadogonyaulax pannea (Norris) Sarjeant, comb. nov., =*Leptodinium panneum* Norris, 1965 ; 796–8, figs. 3, 10–13. Upper Jurassic, England.

Dichadogonyaulax schizoblata (Norris) Sarjeant, comb. nov., =*Leptodinium schizoblatum* Norris, 1965 ; 798–800, figs. 4–5, 14–17. Upper Jurassic, England.

?Litosphaeridium striatoconus (Deflandre & Cookson) Sarjeant, comb. nov., =*Hystrichosphaeridium striatoconus* Deflandre & Cookson, 1955 ; 275–6, pl. 2, fig. 10, text-fig. 36 (Transferred to *Baltisphaeridium* by Downie & Sarjeant 1963 ; 92). Upper Cretaceous, Australia.

Meiourogonyaulax bulloidea (Cookson & Eisenack) Sarjeant, comb. nov., =*Gonyaulax bulloidea* Cookson & Eisenack, 1960b ; 247, pl. 37 fig. 11 text-fig. 4. Upper Jurassic, Western Australia.

Meiourogonyaulax caytonensis (Sarjeant) Sarjeant, comb. nov., =*Gonyaulax caytonensis* Sarjeant, 1959 ; 330–2, pl. 13 fig. 1, text-fig. 1. Middle Jurassic, England.

?Meiourogonyaulax cristulata (Sarjeant) Sarjeant, comb. nov., =*Gonyaulax cristulata* Sarjeant, 1959 ; 332–4, pl. 13 fig. 2, text-fig. 2. Middle Jurassic, England.

Meiourogonyaulax decapitata (W. Wetzel) Sarjeant, comb. nov., =*Gonyaulax decapitata* W. Wetzel, 1966 ; 869, pl. 16 figs 7a–b. Middle Jurassic, Germany.

Meiourogonyaulax superornata (W. Wetzel) Sarjeant, comb. nov., =*Gonyaulax superornata* W. Wetzel, 1966 ; 869–870, pl. 16 figs 8a–b. Middle Jurassic, Germany.

Polysphaeridium belgicum Sarjeant, sp. nov., =*Hystrichosphaeridium fluctuans* sensu Pastiels, 1948 ; 40, pl. 3 fig. 16, *non* Eisenack, 1938 ; 230–1, pl. 16 fig. 1 (Pastiels wrongly cites this as Eisenack 1937). Holotype : the specimen figured by Pastiels, 1948 ; pl. 3 fig. 16. Dimensions : shell 30×35μ, appendages 12 μ long, overall span 60 μ. Eocene—Artesian well, Gand, Belgium.

Psaligonyaulax apatela (Cookson & Eisenack) Sarjeant, comb. nov., =*Scrinodinium apatelum* Cookson & Eisenack, 1960b ; 249, pl. 37 figs. 12–13. Upper Jurassic, Australia.

Psaligonyaulax simplicia (Cookson & Eisenack) Sarjeant, comb. nov., =*Rottnestia simplicia* Cookson & Eisenack, 1961 ; 42, 44, pl. 2 figs. 3–4, text-figs. 1 e–f. Eocene, Rottnest Island, Australia.

Rhaetogonyaulax chaloneri (Sarjeant), comb. nov., =*Gonyaulax chaloneri* Sarjeant, 1963a ; 354, text-figs. 2 (right), 3. Upper Triassic, England.

IV. GENERIC REALLOCATIONS PROPOSED JOINTLY BY R. J. DAVEY C. DOWNIE W. A. S. SARJEANT & G. L. WILLIAMS

Areoligera galea (Maier) Davey, Downie, Sarjeant & Williams, comb. nov., =*Galea galea* Maier, 1959 ; 306, pl. 29 fig. 4. (Transferred to *Baltisphaeridium* by Sarjeant, 1964 ; 176). Oligocene, Germany.

Areoligera lychnea (Maier) Davey, Downie, Sarjeant & Williams, comb. nov., =*Galea lychnea* Maier, 1959 ; 310, pl. 30 fig. 6. (Transferred to *Baltisphaeridium* by Sarjeant, 1964 ; 176). Miocene, Germany.

Areoligera twistringensis (Maier) Davey, Downie, Sarjeant & Williams, comb. nov., =*Galea twistringensis* Maier, 1959 ; 308–9, pl. 30 figs. 3–4. (Transferred to *Baltisphaeridium* by Sarjeant, 1964 ; 176). Oligocene, Germany.

Cleistosphaeridium ashdodense (Rossignol) Davey, Downie, Sarjeant and Williams, comb. nov., =*Hystrichosphaeridium ashdodense* Rossignol, 1962 ; 132, pl. 2 fig. 2. (Transferred to *Baltisphaeridium* by Downie & Sarjeant, 1964; 87. According to Wall 1967 ; 109, this species is a synonym of *Lingulodinium machaerophorum*). Quaternary, Israel.

?Cleistosphaeridium danicum (W. Wetzel) Davey, Downie, Sarjeant & Williams, comb. nov., =*Areoligera danica* W. Wetzel, 1952 ; 396–7, pl. A fig. 5, text-fig. 8. (Transferred to *Hystrichosphaeridium* by W. Wetzel, 1955 ; 34 ; transferred to *Baltisphaeridium* by Downie and Sarjeant, 1963 ; 91). Paleocene, Denmark.

Cleistosphaeridium echinoides (Maier) Davey, Downie, Sarjeant & Williams, comb. nov., =*Hystrichosphaeridium echinoides* Maier, 1959 ; 318–19, pl. 32 figs. 5–6. (Transferred to *Baltisphaeridium* by Downie & Sarjeant, 1963 ; 91). Oligocene, Germany.

Cleistosphaeridium ehrenbergi (Deflandre) Davey, Downie, Sarjeant & Williams, comb. nov., =*Hystrichosphaeridium ehrenbergi* Deflandre, 1947 ; text-fig. 1 no. 5. (Transferred to *Baltisphaeridium* by Sarjeant, 1961 ; 103). Middle Jurassic, France.

Cleistosphaeridium leve (Maier) Davey, Downie, Sarjeant & Williams, comb. nov., =*Galea levis* Maier, 1959 ; 308, pl. 30 figs. 1–2 (Transferred to *Baltisphaeridium* by Sarjeant, 1964 ; 176). Oligocene–Miocene, Germany.

Cleistosphaeridium lumectum (Sarjeant) Davey, Downie, Sarjeant & Williams, comb. nov., =*Baltisphaeridium lumectum* Sarjeant, 1960 ; 139–40, pl. 6, fig. 1, text-fig. 2. Upper Jurassic, England.

Cleistosphaeridium multifurcatum (Deflandre) Davey, Downie, Sarjeant & Williams, comb. nov., =*Hystrichosphaeridium multifurcatum* Deflandre, 1937 ; 76, pl. 16 figs. 1–3 (Transferred to *Baltisphaeridium* by Klement, 1960 ; 59). Upper Cretaceous, France.

?Cleistosphaeridium oligacanthum (W. Wetzel) Davey, Downie, Sarjeant & Williams, comb. nov., =*Hystrichosphaeridium oligacanthum* W. Wetzel, 1952 ; 402–3, pl. A fig. 8, text-figs. 21–2 (Transferred to *Baltisphaeridium* by Downie & Sarjeant, 1963 ; 91). Paleocene, Baltic Region.

Cleistosphaeridium pectiniforme (Gerlach) Davey, Downie, Sarjeant & Williams, comb. nov., =*Baltisphaeridium pectiniforme* Gerlach, 1961 ; 195, pl. 28 fig. 14, text-fig. 18. Oligocene, Germany.

Cleistosphaeridium polytrichum (Valensi) Davey, Downie, Sarjeant & Williams, comb. nov., =*Hystrichosphaeridium polytrichum* Valensi, 1947 ; 818, text-fig. 4 (Transferred to *Baltisphaeridium* by Sarjeant, 1959 ; 339). Middle Jurassic, France.

?Cleistosphaeridium spiralisetum (de Wit) Davey, Downie, Sarjeant & Williams, comb. nov., =*Hystrichosphaeridium spiralisetum* de Wit, 1943 ; 383, text-figs. 2, 11 (Transferred to *Baltisphaeridium* by Downie & Sarjeant, 1964 ; 97). Upper Cretaceous, Netherlands.

Cleistosphaeridium tiara (Klumpp) Davey, Downie, Sarjeant & Williams, comb. nov., =*Hystrichosphaeridium tiara* Klumpp, 1953 ; 390–1, pl. 17 figs. 8–10 (Ttransferred to *Baltisphaeridium* by Downie & Sarjeant, 1963 ; 92). Eocene Germany.

Cleistosphaeridium tribuliferum (Sarjeant) Davey, Downie, Sarjeant & Williams, comb. nov., =*Baltisphaeridium tribuliferum* Sarjeant, 1962 ; 487–8, pl. 70 fig. 4, text-figs. 6c, 7. Upper Jurassic, England.

Exochosphaeridium palmatum (Deflandre & Courteville) Davey, Downie, Sarjeant & Williams, comb. nov., =*Hystrichosphaeridium palmatum* Deflandre & Courteville, 1939 ; 101–2, pl. 3 fig. 1 (Transferred to *Baltisphaeridium* by Downie & Sarjeant, 1963 ; 91). Upper Cretaceous, France.

?Exochosphaeridium pseudhystrichodinium (Deflandre) Davey, Downie, Sarjeant & Williams, comb. nov., =*Hystrichosphaeridium pseudhystrichodinium*

Deflandre, 1937 ; 73, pl. 15 figs. 3–4 (Transferred to *Baltisphaeridium* by Downie & Sarjeant, 1963 ; 93). Upper Cretaceous, France.

Prolixosphaeridium mixtispinosum (Klement) Davey, Downie, Sarjeant & Williams, comb. nov., =*Baltisphaeridium mixtispinosum* Klement, 1960 ; 58–9, pl. 6 figs. 17–19. Upper Jurassic, Germany.

Prolixosphaeridium parvispinum (Deflandre) Davey, Downie, Sarjeant & Williams, comb. nov., =*Hystrichosphaeridium xanthiopyxides* var. *parvispinum* Deflandre, 1937 ; 29, pl. 16 fig. 5 (Raised to specific rank, as *Hystrichosphaeridium parvispinum*, by Cookson & Eisenack, 1958 ; 45 ; transferred to *Baltisphaeridium* by Klement, 1960 ; 59). Upper Cretaceous, France.

?Prolixosphaeridium xanthiopyxides (O. Wetzel) Davey, Downie, Sarjeant & Williams, comb. nov., =*Hystrichosphaera xanthiopyxides* O. Wetzel, 1933, 44–5 ; pl. 4 fig. 25 (Transferred to *Hystrichosphaeridium* by Deflandre, 1937 ; 77 ; transferred to *Baltisphaeridium* by Klement, 1960 ; 59). Upper Cretaceous, Germany.

Systematophora placacantha (Deflandre & Cookson) Davey, Downie, Sarjeant & Williams, comb. nov., =*Hystrichosphaeridium placacanthum* Deflandre & Cookson, 1955 ; 276–7, pl. 9 figs. 1–3 (Transferred to *Baltisphaeridium* by Downie & Sarjeant, 1963 ; 92). Miocene, Australia.

V. GENERIC REALLOCATIONS PROPOSED BY G. L. WILLIAMS & C. DOWNIE

Adnatosphaeridium aemulum (Deflandre) Williams & Downie, comb. nov., =*Hystrichosphaeridium aemulum* Deflandre, 1938 ; 187–9, pl. 9 fig. 12, pl. 10 figs. 5–8, pl. 11 figs. 1–7 (Transferred to *Cannosphaeropsis* by Deflandre, 1947a ; 1574). Upper Jurassic, France.

Adnatosphaeridium caulleryi (Deflandre) Williams & Downie, comb. nov., =*Hystrichosphaeridium caulleryi* Deflandre, 1938 ; 189, pl. 11 figs. 2–3 (Transferred to *Cannosphaeropsis* by Deflandre, 1947 ; 1574). Upper Jurassic, France.

Adnatosphaeridium filamentosum (Cookson & Eisenack) Williams & Downie, comb. nov., =*Cannosphaeropsis filamentosa* Cookson & Eisenack, 1958 ; 47–8, pl. 7 figs. 8–9, pl. 8 figs. 1–2. Middle–Upper Jurassic, Australia.

Adnatosphaeridium filiferum (Cookson & Eisenack) Williams & Downie, comb. nov., =*Cannosphaeropsis utinensis* var. *filifera* Cookson & Eisenack, 1958 ; 46, pl. 7 fig. 4 (Raised to specific rank, as *Cannosphaeropsis filifera*, by Cookson & Eisenack, 1960a ; 8–9). Upper Cretaceous, Australia.

Hystrichokolpoma clavigera (Deflandre) Williams & Downie, comb. nov., =*Hystrichosphaeridium clavigerum* Deflandre, 1937 ; 71, pl. 14 figs. 1–2 (Transferred to *Baltisphaeridium* by Downie & Sarjeant, 1963 ; 91). Upper Cretaceous, France.

VI. TAXONOMIC REVISIONS MADE BY OTHER AUTHORS

Taxonomic revisions made by other authors in the period since publication of our ' Studies on Mesozoic and Cainozoic dinoflagellate cysts ' have caused the omission, from the preceding sections, of a number of species transferred to new genera in the earlier work without new combinations for them being validly published. It is felt that these should be briefly listed here, in order to provide comprehensive coverage.

(a) The species *Hystrichosphaeridium zoharyi* Rossignol, 1962, whose transfer to the genus *Polysphaeridium* was tentatively proposed by Davey & Williams (1966b ; 95), has been made type for a new genus, *Hemicystodinium*, by Wall, (1967 ; 110) on the basis of its development of an epitractal archaeopyle.

(b) The species *Hystrichosphaeridium israelianum* Rossignol, 1962 (placed in the genus *Baltisphaeridium* by Downie and Sarjeant, 1964) and *Hystrichosphaeridium centrocarpum* Deflandre and Cookson, 1955 (placed in the genus *Baltisphaeridium* by Gerlach, 1961), were transferred to the genus *Cleistosphaeridium* by Davey, Downie, Sarjeant & Williams (1966 ; 170). Both have been placed in a new genus, *Operculodinium*, by Wall (1967 ; 110–11), *H. centrocarpum* being chosen as type. This genus resembles *Exochosphaeridium* Davey, Downie, Sarjeant & Williams (1966 ; 165) in its development of a single-plate precingular archaeopyle, differing in the apparent absence of an enlarged apical process, and in the presence of striations on the bases of the processes.

(c) The species *Hystrichosphaeridium machaerophorum* Deflandre & Cookson, 1955 (placed in the genus *Baltisphaeridium* by Downie & Sarjeant, 1963), was transferred to the genus *Cleistosphaeridium* by Davey, Downie, Sarjeant & Williams (1966 ; 165). It has been made the type of a new genus, *Lingulodinium*, by Wall (1967 ; 109–10), on the basis of its possession of a precingular archaeopyle formed by loss of the equivalents of four or five plate areas.

(d) In three instances, the proposed type species of new genera formulated in our earlier work were not initially validly transferred to those genera (I.C.B.N. Art. 33) and were subsequently validly transferred by Loeblich & Loeblich, (1968). These are : *Dichadogonyaulax culmula* (Norris, 1965) Leoblich & Loeblich, 1968 ; 211 [=*Dichadogonyaulax culmula* (Norris, 1965) Sarjeant, 1966b ; 153, nom. nud.] ; *Duosphaeridium nudum* (Cookson, 1965) Loeblich & Loeblich, 1968 ; 211 [=*Duosphaeridium nudum* (Cookson, 1965) Davey & Williams, 1966b ; 97, nom. nud.] ; and *Rhaetogonyaulax rhaetica* (Sarjeant, 1963) Loeblich & Loeblich, 1968 ; 212 [=*Rhaetogonyaulax rhaetica* (Sarjeant, 1963), 1966 ; 97, nom. nud.].

(e) As a result of a redefinition of the genus *Cribroperidinium* Neale & Sarjeant (1962), proposed by Davey (1968a ; 125), the species *Gonyaulax edwardsi* Cookson & Eisenack 1958, *Gonyaulax muderongensis* Cookson & Eisenack 1958, and *Gonyaulax orthoceras* Eisenack 1958 *sensu stricto* (i.e. excluding *G. parorthoceras* Davey 1968b), whose reallocation to *Gonyaulacysta* was proposed by Sarjeant (1966 ; 130 ; 131 ; 121–3), are now transferred to *Cribroperidinium* (Davey 1968a ; 128).

Davey (*op. cit.*) also validly published the following combinations : *Cleistosphaeridium multifurcatum* (Deflandre, 1937), *Cleistosphaeridium polypes* (Cookson & Eisenack, 1962), *Cleistosphaeridium pseudhystrichodinium* (Deflandre, 1937) [wrongly spelled *pseudohystrichodinium* in all citations], *Hystrichokolpoma ferox* (Deflandre, 1937) emend., *Oligosphaeridium anthophorum* (Cookson & Eisenack, 1958) and *Oligosphaeridium reniforme* (Tasch, *in* Tasch, McClure & Oftedahl, 1964). He considered no change in the generic allocation of *Hystrichosphaeridium difficile* Manum & Cookson, 1964, to be necessary.

(f) Two recent large papers exhibit a high degree of taxonomic overlap with our 1966 volume. One of these (Morgenroth, 1966) has priority of publication by one month ; it is hoped that the systematic problems created will be sorted out in a later paper. The second (Clarke & Verdier, 1967) does not have priority : a short note, giving the resulting synonymy, has recently been published (Clarke, Davey, Sarjeant & Verdier, 1968).

(g) Pending a restudy of its holotype, no proposal of generic transfer is here made respecting *Hystrichosphaeridium tridactylites* Valensi, 1955a.

(h) A new name, *Acanthaulax*, was proposed to replace the invalid junior hononym *Acanthogonyaulax* by Sarjeant, 1968, and all constituent species were transferred.

VII. ERRATA AND CURATORIAL AMENDMENTS

The following errata have been noted and merit correction :

p. 28 line 20. For ' *nomen nudum* ', read ' *nomen oblitum* '.
p. 63 line 8. Revise to read ' V. 51708 (1) '.
p. 65 line 5. Revise to read ' Pl. 7 fig. 9 ; pl. 8 fig. 6 '
p. 70 Delete parentheses from : ' Maier 1959 ' (lines 15 and 24) ; 'Eisenack and Cookson, 1960 ' (line 18) ; ' Deunff, 1961 ' (line 20) ; and ' Mackó, 1957 ' (line 22).
p. 75 line 1. Revise to read ' V. 51709 (3) '.
line 6. Revise to read ' V. 51709 (1) '.
p. 78 Delete last sentence of ' Remarks '.
p. 80 Text-fig. 16. 1p and 1''' should be interchanged in both drawings.
p. 92 line 4. Alter to read ' *Polysphaeridium subtile* sp. nov.'
p. 95 line 12. Alter to read ' (Weiler, 1956) '.
p. 100 line 33. Alter to read ' *Homotryblium tenuispinosum* sp. nov.'
p. 133 lines 15–16. Insert between these lines ' Plate 22 fig. 2.'
line 22. Alter to read ' *heslertonensis*'.
p. 140 line 20. For ' junior homonym ' read ' junior synonym '.
p. 144 line 13. Revise to read ' V. 51710 (1) '.
p. 147 line 13. Alter to read ' *Xiphophoridium alatum* sp. nov.'
line 15. Correct page number to ' 487 '.
p. 154 line 20. Alter to read ' *Wanaea spectabilis* (Deflandre & Cookson), Cookson & Eisenack, 1958 '.

p. 166 line 26. Alter to read ' *Cleistosphaeridium diversispinosum* sp. nov.'
p. 166 line 16. Alter to read ' *Exochosphaeridium* '.
p. 167 line 5. Alter to read ' *Cleistosphaeridium* '.
p. 170 line 21. Delete ' Miocene, Australia ': insert ' Quaternary, Israel '.
pp. 182–198. Throughtout this section, the left and right antapical horns are interchanged in the descriptions. It is the *right* horn that is typically reduced or absent.
p. 195 lines 20, 21. Alter to read ' *solida* '.
line 38. Alter to read ' *solidum* '.
p. 197 line 28. Alter to read ' Sub-Genus WETZELIELLA (RHOMBODINIUM) (Gocht) Alberti, 1961 '.
p. 201 line 29. Alter to read ' *Paranetrelytron* '.
p. 219 line 10. Alter to read ' *Membranilarnacia* '.
p. 225 line 3. Alter to read : ' 1948 *Membranilarnax pterospermoides* O. Wetzel, 1933, of Pastiels '.
p. 245 Index. Insert to give : ' *Heslertonia heslertonensis* **133.** pl. 22 fig. 2 '.

Caption for Plate 3. Explanations of Figures 3 and 4 should be transposed, and altered to read ' *Cordosphaeridium* '.
Caption for Plate 9 fig. 6. Alter to read : ' 103·25 m'.
fig. 7. ' Holotype ' should read : ' Paratype '. Figure shows left-to-right reversal.
Caption for Plate 10 fig. 4. Alter to read : ' V. 51708 (1) '.
Caption for Plate 11 fig. 9. Revise to read : ' *disjunctum* '.
Caption for Plate 13 fig. 1. Alter to read : ' V. 51425 (2) '.
Caption for Plate 15 figs. 1–2. Correct to read : ' *Gonyaulacysta* '.
fig. 5. Alter to read ' V. 51725 (1) '.

For curatorial reasons, it is proposed that slides containing a single specimen should not have a number 1 in parentheses. This proposal necessitates the following changes :

V. 51715 (1) becomes V. 51715 (p. 213, line 10).
V. 51720 (1) becomes V. 51720 (caption for Plate 23 fig. 6).
V. 51721 (1) becomes V. 51721 (p. 209 line 26 : caption for Plate 22 fig. 5).
V. 51726 (1) becomes V. 51726 (p. 210 line 6 ; caption for Plate 21 fig. 4).
V. 51733 (1) becomes V. 51733 (p. 207 line 3 ; caption for Plate 21 fig. 1).
V. 51735 (1) becomes V. 51735 (p. 161 line 15 ; caption for Plate 9 fig. 6).
V. 51736 (1) becomes V. 51736 (p. 163 fig. 5 ; caption for Plate 9 fig. 8).

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R. J. Davey, B.Sc., Ph.D., F.G.S.
Formerly of Bernard Price Institute for Palaeontological Research
University of the Witwatersrand
Johannesburg
South Africa

C. Downie, B.Sc., Ph.D., F.G.S.
Dept. of Geology
University of Sheffield
England

W. A. S. Sarjeant, B.Sc., Ph.D., F.G.S., F.L.S.
Dept. of Geology
University of Nottingham
England

G. L. Williams, B.Sc., Ph.D.
Pan-American Petroleum Corp.
Research Center
Tulsa
Oklahoma, U.S.A.